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Tim G Harrison, Lauren Hughes and Dudley E Shallcross
School of Chemistry
Bristol University
Bristol BS8 1TS
t.g.harrison@bristol.ac.uk
laren.hughes@bristol.ac.uk
d.e.shallcross@bristol.ac.uk

Jersey Schools Science Week: An outreach case study

Abstract

During a single week the combined Bristol Centres for Excellence in Teaching and Learning (CETLs) outreach team of 8 scientists worked in the island's primary and secondary schools, delivering lectures and running workshops, thus forming the first 'Jersey Science Week'. They also gave demonstrations and the opportunity for hands-on investigation using their Mobile Teaching Unit. The number of students engaged during the week is impressive on its own: they had contact with 22 schools and approximately 4500 students. This case study gives the background to the ambitious event and the lessons learnt for future events of this scale.

Background to Combined CETLs' Outreach

The combined Bristol CETLs (Chemistry: Bristol ChemLabS and Medical Sciences: AIMS) were given an additional sum of money to that of the original CETL bids from which the Mobile Teaching Unit (MTU) was created. The main purpose of this bespoke mobile teaching laboratory on an HGV Class 2 lorry is to provide postgraduate surgical skills training away from the University and on location in hospitals. When not in use for this prime purpose it is available for outreach work.

The Bristol ChemLabS School Teacher Fellow^{1,2} in collaboration with the Outreach Director had previously developed and used a suite of primary workshop experiments³ over a two year period and an age adaptable lecture demonstration entitled 'A Pollutant's Tale'⁴ that had already been given well over 350 times, mainly to school audiences. The AIMS CETL Teaching Assistant had also developed subject specific workshops. Prior to the Jersey Science Week there had been five one day events when joint outreach had taken place, three secondary school visits, one primary school and a regional science festival. The mixture of human biology sessions in the MTU and either primary chemistry workshops and assemblies or human biology and chemistry lecture demonstrations had already proved a winning combination. In primary schools every pupil in years 4-6 in a large rural primary school had enjoyed a demonstration assembly and at least 1 hour of practical work. The secondary schools' science days had seen an average of 700 students plus their teachers engaged per day. The Jersey Education Department was approached by Bristol to have all three types of engagement running simultaneously with the aim of enthusing, engaging, educating and entertaining as many students and their teachers as possible.

What was the engagement?

From March 31st to April 4th 2008 an outreach team from the University of Bristol made up of scientists from the two University of Bristol Centres for Excellence in Teaching and Learning (CETLs), Bristol ChemLabS and AIMS, visited the Island to undertake an ambitious programme of outreach work.

During the week the team worked in primary and secondary schools, delivering lectures and running workshops. They also gave demonstrations and the opportunity for hands-on investigation in their MTU. The number of students engaged during the week is impressive on its own: they had contact with 22 schools and approximately 4500 students. However it was the feedback that we received on the quality of the work that confirmed the value of the week.

The one hour lecture demonstration 'A Pollutant's Tale' was given 19 times in five days to audiences totalling more than 3100 students from Year 7 to Year 13 by Tim Harrison the Bristol ChemLabS School Teacher Fellow. The demonstrations involved in this popular lecture are the sort of experiments that turned many of the readers of this article onto science in the first place. They included the classical demonstrations with liquid nitrogen, dry ice, oxygen foam, minor explosions and colour changes.

The secondary schools' science days had seen an average of 700 students plus their teachers engaged per day.

The demonstrations were made appropriate to the audience age group as Harrison has had more than 25 years teaching experience at secondary state schools. This event is only one of a menu of outreach activities aimed at secondary school students developed by Bristol ChemLabS.⁶

The primary engagements involved whole school assemblies on the topic of 'gases in the air' and hands-on chemistry workshops where pupils in Years 5 and 6 from 10 separate primary schools had the opportunity to develop their measuring, investigatory and team work skills whilst working alongside postgraduate chemists. Dr. Alison Rivett of Bristol ChemLabS gave the assemblies using demonstrations taken from those used in the secondary lecture demonstrations but with a simplified background 'chemical story'.

The workshops themselves comprised a circus of three experiments taken from a simplified iodine clock investigation, the (gravimetric) determination of the sugar content of fizzy drinks, an investigation of acid concentration with magnesium and polymers (slime and polymorph). In each host school the school hall was converted into a 'science laboratory' for the day. Lab coats, safety glasses and gloves were provided for all participants and their teachers. The need for the availability of several experiments was mainly for the sanity of the postgraduates who would have had thirty 35-40 minute practicals to introduce and supervise in the week!

The postgraduate chemists involved were all very experienced chemistry communicators and had been through the Science and Engineering Ambassador Scheme (SEAS)⁵ as around 200 PG chemists had in the last 2-3 years at Bristol.

In all 1200 primary pupils saw the assemblies at the host schools and 500 pupils had the opportunity of 'doing science' in the workshops during the week⁷.

Due to the small size of the Jersey roads, having arrived on the Island by ferry the MTU and the AIMS outreach team was based on-site at a single school for the entire week with schools bringing students for the teaching sessions. The team comprised of Dr. Lauren Hughes, a teaching assistant at the University of Bristol who is experienced in undergraduate and science communication in the Department of Physiology and & Pharmacology and Mr. Pete Dickens, a technician in the department. Throughout the week students from 9 schools attended sessions in the MTU, these ranged from Year 3 to

Year 13. The majority of the teaching targeted Biology A level and BTEC students studying human biology as part of their courses. Between 5 and 6 sessions were run each day, totally 25 sessions in the week. The MTU offers teaching in small groups, seating 20 students at a time, which allows a lot of interactions with the team and students. Over the week 270 students visited the MTU, with nearly half of these students (112) receiving two sessions either back-to-back or on separate visits in the week.

The two A level, BTEC and GCSE sessions offered were one-hour long sessions titled 'The Cardiovascular System' and 'The Respiratory System' focusing on the anatomy and physiology of the two systems of the body. Each session involved hands-on teaching using anatomical models and X-rays and physiological equipment for students to listen to their own hearts, record their ECG and test their lung function. Within the sessions students learnt how to generate scientific questions and how to go about answering them by being able to generate their own physiological data within the mobile laboratory which could be analysed back in class.

The sessions run for primary students were along the same theme with Year 5 and 6 students learning about 'The Heart' and Year 3 and 4 students attending a session on 'What's Inside My Body?' These were 40 minutes in length and the students enjoyed being able to explore inside Anatomy man with his removable organs and learn about bones with Skeleton man.

All of the sessions in the MTU offered students opportunities to see, whether via video clips or actually interacting themselves with pieces of equipment including a spirometer and an ECG machine, what they would otherwise not have had the chance to use in class. The sessions also served as useful revision running up to AS/A level exams as highlighted by comments by a number of the teachers, and they also provided the teachers with some refresher facts and further insight into Physiology.

Why Do Outreach on Jersey?

There were a number of drivers for this particular exercise apart from the usual desire to engage with school students to promote the sciences:

1. This was an opportunity to work with a group without a 'local' University Chemistry department in the British Isles.

Within the sessions students learnt how to generate scientific questions and how to go about answering them by being able to generate their own physiological data within the mobile laboratory which could be analysed back in class.

2. It was hoped to be an exemplar of a strategy to impact on a 'harder to reach' community.
3. As a feasibility study (financially and logistically) to inform us for future undertakings such as a similar exercise within continental Europe.
4. To compare the approach taken with outreach undertaken in a week on the island of Malta in 2007.
5. Jersey was a 'blank sheet' so it should be easier to assess both short and long term impact of such activities. We were told that very few students go on to read degrees in the chemical sciences as there are not many opportunities for employment as such on the Island.
6. It was the first time that we took the MTU away from the UK mainland.
7. To increase aspirations amongst the Island's potential young scientists. The school students have little contact with scientists at higher education establishments and it is far easier for the scientists to go to Jersey than students in great numbers to go to the mainland.
8. Lastly, despite being hard work, outreach anywhere is fun.

Quotes from Jersey

Secondary feedback

"This is a huge thank you from De La Salle. It has been wonderful to be involved in Science Week. The Year 12 biologists had two great sessions (Lungs and Heart). The level was pitched just right and it was a fantastic revision for them before their AS exams. It also gave them confidence and gave them the opportunity to see a couple of pieces of equipment that we cannot use in school.

The lecture demonstration, A Pollutant's Tale, was absolutely brilliant. It was aimed perfectly for our Year 8 students who came away saying it was 'awesome'. Science doesn't have to be dry and boring (my lessons being the exception, you understand!)." **Head of Science 11-18 Boys School**

Primary Feedback

"The assembly was simply awesome. I had some concerns as to the suitability for the very young ones but these proved to be totally misplaced. They sat there fascinated with their eyes getting wider and wider. One of the most pleasing things was to hear the children at the end of the day rushing out to their parents to tell them about their fantastic assembly. Please bring them back again!" **Deputy Head of a Primary School**

Education Department Feedback

"The week exceeded all our expectations and the feedback from both staff and students has been excellent. The only complaints that I have received are from schools that did not take part and are now wishing that they had! The aim of the week had been to raise the aspirations of students and excite them about science. There is no doubt that this aim has been met and we hope that we will be able to maintain and develop our links with Bristol in order to continue this work."

Andy Gibbs Head of Careers & Work Related Learning, Education, Sport and Culture, Jersey

Sustainability

Whilst the event was subsidised by the combined CETLs in the payment of the two academics and technician involved,

the majority of the costs for transport, consumables, accommodation and subsistence were met by the Jersey Education Authority. The cost, for Jersey, was less than £2.00 per student engaged.

Other Mobile Laboratories

Within the UK there are three mobile physics laboratories operating attending schools, science festivals and other events, the 'Lab in a Lorry'⁸ project was created in 2004 by the Institute of Physics (IOP) and the Schlumberger Foundation initially as a three year programme. These large articulated vehicles utilise trained volunteers who are physicists or engineers to work with students. The three physics experiments that the lorry carries are designed to inspire Key Stage 3 (KS3) students (11 -14 year olds) and also aim to make 'science careers more attractive' to youngsters. The free of charge Lab in a Lorry visits were created 'because of our concerns about the long-term supply of scientists and engineers in the UK & Ireland.'

The approach from the Bristol CETL's use of a mobile lab in bulk outreach differs from the IOP's in several areas:

- Only Bristol University staff and postgraduates are used.
- The mobile teaching unit is not purpose built for schools outreach.
- The chemists make use of the vehicle to carry equipment that is then used in school classrooms and laboratories thus engaging many more students per visit.
- The program of activities for the MTU encompasses KS2-4 and Post 16 not just KS3.
- Bristol does not have staffing solely for this project.
- There is a charge towards the cost of the events.

Where there is similarity

- All the relevant pieces of kit and materials are taken into the school so there is no reliance on the venue.
- The mobile teaching unit does provide additional space within a school for science activity.
- The use of practicing scientists in promoting science.
- The underlying premise is that science is best learnt by doing.

The use of mobile laboratories is not just limited to the UK. For example In the United States there are 12 mobile labs in nine states visiting their local schools. These are mainly delivering bioscience practical workshops⁹. Amongst these are Boston University School of Medicine's 'MobileLab'.

What Can Be Learnt From This Experience?

In previous papers we have discussed the advantages of the School Teacher Fellow concept in undergraduate teaching and outreach^{1,2} and the training and advantages gained by postgraduates through outreach³. In addition to these continued benefits we note the following:

1. Working with the Local Education Authority representatives cut down on a lot of the preparation paperwork and logistical problems. The Jersey team organised the scheduling which not only involved the host schools but also the timetable for neighbouring schools to visit the host schools. The provision of a central 'stores' (an appropriated office) allowed some technician space, a store for the liquid nitrogen and carbon dioxide cylinders (for making dry ice) and made the 're-technicianing' of all

the outreach kits very easy. The use of a department van also aided the delivery of the primary kits to schools. The department dealt with the logistics and special permits needed to get the MTU onto the Island.

2. The decision to have an additional postgraduate to 'ride shotgun' was very useful. He was not only available for transportation, local purchasing and on-the-spot technical assistance but was also available to stand in at short notice when a flight bringing in a scheduled replacement postgraduate chemist and additional academic was cancelled.
3. This form of condensed outreach is a very powerful method for interacting with large numbers of remote students in such a short time and at a low per capita cost. In Malta a much smaller team of two academics went out for one week and, although the outreach was very well received, a larger team would have been more effective. Here the target audience was only KS4 science and Post 16 chemistry students. Altogether over 1100 students with 100 teachers from 19 of the 22 church secondary schools attended nine lecture demonstrations on climate chemistry. A separate Continual Professional Development (CPD) evening session on climate change for science and geography teachers was also arranged. The reason for lower numbers of students was the size of the venues within the schools.
4. One difficulty in Malta was that we were reliant on equipment and chemicals being locally sourced. This was not ideal as even standard laboratory equipment is not so plentiful in all the schools visited. Taking the MTU with our equipment on board was certainly less stressful than having to rely on others gathering it for you.

In both Jersey and Malta this was the first time that the organisers had worked with such an outreach team for prolonged engagement. In both cases the students were eager to see a practical demonstration being applied to theory that they had or were studying in science lessons.

Unexpected Outcomes

1. The initial planning of a one day conference on leading edge science as CPD for the Island's science teachers. It is envisaged that four or five of Bristol's scientists would give presentations on their current work to reengage the scientist within the science teachers. Through previous experiences of providing CPD for members of CHeMneT, Bristol ChemLabS network of chemistry/science teachers, we know that practicing teachers like to find out what is going on in the wider world of science but have little organised opportunity to do so. Keeping up to date with their subject matter is part of most teachers' contracts although school organised CPD is generally linked with teaching issues rather than subject knowledge.
2. There is a possibility of three day chemistry summer schools for senior Jersey Science students being held at Bristol from 2009 onwards.
3. The high level of interest shown by the media in the event. This included one television appearance on a local news programme, three separate radio interviews and newspaper interest.

Summary

A well planned series of outreach engagements, organised in cooperation with an education department, can deliver a high quality, age-relevant event to large numbers of school students of all ages at low per capita cost through the use of a

small, well trained team. When working with large numbers of schools it is desirable to bring in the local education authority to assist with funding, the organisation of the schools themselves, dealing with local media and for help with local logistics.

Notes:

Bristol ChemLabS stands for Bristol Chemical Laboratory Sciences

AIMS stands for Applied and Integrated Medical Sciences

Additional Information

Bristol ChemLabS outreach leaflet
www.chemlabs.bris.ac.uk/outreach/OutreachLeafletUKWeb.pdf

For further information on Bristol ChemLabS Outreach please see:

www.chemlabs.bris.ac.uk/outreach/

For further information on AIMS Outreach please see:

www.bristol.ac.uk/cetl/aims/mobile_lab

For information on CHeMneT please see:

www.chemlabs.bris.ac.uk/outreach/chemnet

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